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(54) **METHOD AND DEVICE FOR MONITORING AN INSERTION SYSTEM FOR A WEAVING MACHINE**

VERFAHREN UND VORRICHTUNG ZUR ÜBERWACHUNG EINES EINTRAGSYSTEMS FÜR EINE
WEBMASCHINE

PROCÉDÉ ET DISPOSITIF POUR SURVEILLER UN SYSTÈME D'INSERTION POUR UN MÉTIER
À TISSER

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(56) References cited:
EP-A- 1 731 645 JP-A- 2 160 958
JP-A- 2 175 956

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Description

[0001] The invention relates to a method and a device for monitoring an insertion system for a weaving machine, in particular for an air weaving machine.

[0002] Known insertion systems for inserting weft threads into a shed of weaving machines inter alia comprise a storage tank containing fluid, fluid lines, valves and nozzles. The consumption of the fluid used for the insertion of weft threads has to be kept as low as possible. In order to keep the consumption as low as possible, monitoring the fluid stream is advantageous, so that any occurring problems, for example due to defects in the fluid lines and/or due to blocked nozzles, can be detected quickly and be resolved immediately.

[0003] DE 19936071 C1 discloses a monitoring system for an air weaving machine which comprises flexible pressure hoses as fluid lines, the pressure hoses being provided with electrical current-carrying conductors which interrupt the current when a defect occurs in the pressure hose and generate a signal in the control unit of the weaving machine, as a result of which a weaving stop is caused.

[0004] It is known from JP 2002138346 A to measure an air flow not directly, but to calculate it on the basis of the compressed air pressure prevailing in a storage tank, the number of blowers, the efficiency of the blowers, the surface area of the cross section of the blowers and the opening of an associated valve.

[0005] It is also known to determine the actual value of a fluid stream by means of a sensor and to display the value determined on a display apparatus, for example by means of a pointer and/or by means of a monitor.

[0006] A method for monitoring an insertion system according to the preamble of claim 1 and a corresponding device are known from JP-A-2 175 956.

[0007] It is an object of the present invention to provide a method and a device in which monitoring can be carried out in a simple and reliable manner on the basis of a measured fluid stream.

[0008] This object is achieved by means of a method for monitoring an insertion system of a weaving machine according to claim 1 and a corresponding device according to claim 10.

[0009] By comparing the actual value with an expected value, faults or irregularities can be determined in a simple manner, thus making a quick intervention possible. Hereby, measuring an actual value can be carried out continuously and/or at certain intervals. Monitoring is possible both during weaving and during standstill of the weaving machine. Preferably, a fluid stream is measured over a certain measurement period, with a mean value of the fluid stream over the measurement period being determined as the actual value. In this embodiment, the mean value is compared to an expected value, in order thus to minimize the effect of temporary fluctuations.

[0010] Groups of nozzles, for example groups of relay blowers, are each connected to a certain supply tank via

an associated shut-off valve, with the fluid stream for each of a number of groups of nozzles which are connected to an associated shut-off valve being measured using a sensor device, with a mean value for the fluid stream being determined for a number of these groups of nozzles as expected value. In this case, the actual measured value for the fluid stream can be compared to the abovementioned expected value for the fluid stream for each group of nozzles and it may be determined that the difference between the actual value and the expected value for the fluid stream for a certain group of nozzles is substantially depending on the standard deviation of the measured values with which the abovementioned mean value has been determined. Determining in accordance with this method whether a substantial difference is present is particularly advantageous in order to determine if a certain nozzle, for example a certain relay blower, is soiled (clogged up).

[0011] According to an advantageous embodiment, a main fluid stream in a main supply line of a weaving machine is measured. An insertion system for weft threads of a weaving machine comprises, for example, a main storage tank, fluid lines, valves and nozzles. Thereby the sensor device is positioned, for example, between a compressor for supplying compressed fluid and the main storage tank. This makes it possible to measure entirely the fluid consumption of the weaving machine, more particularly the consumption of fluid which is supplied to the weaving machine.

[0012] Usually, several valves are connected to a main storage tank of a weaving machine, with a group of relay blowers and/or main blowers being connected to each valve. Preferably, by setting reference parameters for the valves, which means inter alia by suitably opening and closing the shut-off valves, suitably setting the throttle valves and/or suitably setting the pressure-regulating valves, a corresponding reference setting for the weaving machine is provided. Thereby, an expected value and/or an actual value for the fluid stream can be determined for said reference setting. In this manner, several reference settings can be obtained and different assemblies can be monitored by one sensor device.

[0013] According to one embodiment, a leakage fluid stream which is present in the main supply line is measured. To this end, for example, the shut-off valves which are connected to the main storage tank are closed off completely. If certain lines are fitted with a throttle valve, then the through flow, for example, through the throttle valve is minimized by setting the throttling action of the throttle valve to its maximum setting. An expected value for such a configuration is low. For example, an expected value for the flow, more particularly for the mass flow, of the fluid stream is approximately 0.2 to 0.8 Nm³/h (normal cubic meter per hour). If, for example, a higher actual value is measured, then this may indicate a defect in the line system.

[0014] According to another embodiment, at least one expected value for the fluid stream is determined by

means of a measurement for a reference setting, whereby, for example, only one shut-off valve is open. If the assembly which is connected to the shut-off valve is also provided with a throttle valve or several throttle valves, the measurement for a reference setting is carried out with the throttle valve or throttle valves opened to a maximum degree in order to achieve a maximum fluid stream through the assembly. In specific embodiments, individual throttle valves may be connected thereby to separate nozzles associated with a shut-off valve. By actuating these throttle valves, it is possible to determine the fluid streams passing through separate nozzles in these specific embodiments. In other embodiments, it is possible to provide several sensors by means of which fluid streams from separate or groups of nozzles can be measured.

[0015] Preferably, in order to determine expected values, a fluid stream is measured according to a reference setting of the weaving machine. The expected value thereby corresponds to a value at a certain reference setting of the weaving machine. If there are no changes in the boundary conditions, then no change in the actual value should be detected, either. As a result thereof, it is possible to quickly detect the changes occurring during operation, which changes occur, for example, as a result of faults.

[0016] According to one embodiment, a fluid stream is measured from at least one relay blower which is connected to a shut-off valve and/or from at least one main blower which is connected to a shut-off valve, in order to determine an actual value of the fluid stream for the at least one relay blower and/or for the at least one main blower.

[0017] According to another embodiment, an expected value for a fluid stream from a nozzle or a group of nozzles, such as from a relay blower, a group of relay blowers, from a main blower and/or from a group of main blowers is determined. The fluid stream from a nozzle of a group, such as from a relay blower of a group of relay blowers and/or from a main blower from a group of main blowers, may be determined by means of a correction factor and taking into account the number of nozzles of the group, such as the number of relay blowers of the group and/or the number of main blowers of the group. Usually, two or three relay blowers are connected to a shut-off valve. However, it is also possible for fewer or more relay blowers to be connected to one shut-off valve. As a result of the correction factor, the effect which the number of blowers of a group of blowers connected to one shut-off valve has on the expected value for the fluid stream for this group can be taken into account. Thus, it is for example possible that an expected value for a fluid stream is determined for a group of three blowers which are connected to a shut-off valve on the basis of a measured value of a similar group of two blowers which are connected to a shut-off valve, with a correction factor being used to take into account the different number of blowers per group. Usually, the number of blowers and

a fluid stream are not linearly dependent on one another. As a result of additional lines, the limited passage of the valves and the like, the losses which have to be taken into account for a group with several blowers are usually higher. Due to the correction factor, it is still possible, however, to compare individual groups having different numbers of nozzles or blowers. An actual value of a fluid stream depends inter alia on the supply pressure of the fluid, which can be adjusted by means of a pressure-regulating valve, for example.

[0018] Reliable monitoring is possible, in particular by comparing the fluid streams passing through the different groups of nozzles which are fed at the same supply pressure, since in this case, when comparing the fluid streams passing through the various groups, the supply pressure is not relevant.

[0019] The object is furthermore solved by a device for monitoring an insertion system for a weaving machine according to claim 10, in which the device comprises a sensor device for measuring at least one actual value of a fluid stream and in which the device comprises a processing device connected to the sensor device for comparing a measured actual value of the fluid stream with an expected value of the fluid stream. By comparing the actual values with expected values, it is possible to assess an actual value. This enables an early and quick fault detection. In the context of the invention, the phrase "a processing device connected to the sensor device" is understood to include any type of connection, for example with wires or wireless, for example a radio link, as a result of which data transmission or signal transmission between the sensor device and the processing device is possible, at least unidirectional from the sensor device to the processing device. According to a variant, bidirectional data transmission or signal transmission between the two is possible.

[0020] According to one embodiment, the sensor device comprises a sensor arranged in a main supply line of the weaving machine. It is possible, for example, to use a flow meter as a sensor which can determine or measure the amount of fluid across a certain time interval independently from the pressure of the fluid. As a flow meter, a "mass flow meter" may be used which, for example, uses thermal properties of the fluid stream in order to determine the mass flow. By arranging the sensor in the main supply line, it is possible to monitor the consumption of fluid which is taken up by the weaving machine using only one sensor. In this case, use is made of the fact that the shut-off valves and/or throttle valves can be switched independently from one another in order thus to create different reference states or reference settings, in which information is made available in the processing device about the states or settings of the shut-off valves and/or throttle valves in order thus to determine through which lines the fluid flows.

[0021] Alternatively or additionally, the sensor device may comprise a sensor associated with at least one nozzle, for example a sensor associated with at least one

relay blower and/or at least one main blower.

[0022] According to another embodiment, the device comprises a storage device in which at least one expected value for the fluid stream is stored, more particularly an expected value which has been determined using a reference setting. The storage device preferably comprises a memory which can be repeatedly rewritten, so that the expected values can be adapted to the changed configurations. Preferably, a measuring cycle is started after the weaving machine has been set in order to measure the expected values at a reference setting or at several reference settings and to subsequently store them in the storage device.

[0023] According to a preferred embodiment, correction factors are stored in the storage device for separate relay blowers and/or for several relay blowers connected to the shut-off valves, as a result of which the number of relay blowers connected to a shut-off valve can be taken into account for the associated expected values. The correction factors are preferably also stored in a rewritable memory in order to be able to incorporate a change to a modification of the number of relay blowers connected to each shut-off valve.

[0024] According to one embodiment, the storage device is connected to an input device by means of which data, such as correction factors and/or expected values, can be entered, in particular can be entered manually. Therefore an easy setting is possible. The storage device is also connected to the sensor device in order for the sensor device to store measured values, with the sensor device for example being connected to the storage device via the processing device.

[0025] The processing device is preferably connected to a display device on which measured values, expected values and/or values derived there from, such as deviations between the measured and expected values, can be displayed, for example optically and/or acoustically. Preferably, the display screen or display of the weaving machine serves as the display device. The values displayed may be reproduced in the form of numerical values and/or graphic representations. If the weaving machine is not provided with a device according to the invention, this may be indicated on the display screen of the weaving machine in a corresponding manner.

[0026] Further characteristic features and advantages of the invention follow from the following description of the exemplary embodiments illustrated in the drawings.

Fig. 1 shows a diagrammatic representation of a weaving machine comprising a device according to the invention;

Fig. 2 shows a diagrammatic representation of an insertion system for an air weaving machine which is suitable for applying a method according to the invention;

Figs. 3 to 5 show variant embodiments for an inser-

tion system similar to that of Fig. 2.

[0027] The weaving machine illustrated in Fig. 1 comprises a device 1 according to the invention. The device 1 comprises a sensor device 2 for measuring at least one actual value of a fluid stream, for example for measuring the actual flow of a fluid stream. The sensor device 2 is arranged near the frame 3 of the weaving machine. The sensor device 2 is also arranged near the main supply line 4 of the weaving machine. The sensor device 2 comprises a sensor 5 which is connected to a processing device 6. In addition, the device 1 comprises a storage device 7, an input device 8 and a display device 9.

[0028] As is indicated in Fig. 2, the device 1, more particularly the processing device 6 of the device 1, comprises a storage device 7 for storing values. The processing device 6, more particularly the storage device 7 of the processing device 6, is connected to the input device 8. The processing device 6 of the device 1 is also connected to a display device 9, more particularly to the display screen of the weaving machine. The storage device 7 and the input device 8 are also connected to the display device 9. The input device 8 is for example formed by an input which can interact with an electronic system, such as a USB input bus or any other input bus. According to a variant embodiment, the input device 8 can also act as an output device. According to another variant, the display device 9 can also act as input device; it can, for example, be designed as a so-called "touch screen". The expression "connected" in this case also refers to any kind of connection which makes data transmission or signal transmission possible, at least unidirectional or, preferably, bidirectional.

[0029] Fig. 2 diagrammatically shows an insertion system 10 for a weaving machine, more particularly for an air weaving machine. With the insertion system 10 illustrated in Fig. 2, compressed air is used as the fluid. In this case, the fluid stream consists of a compressed air stream. Of course, this description is also applicable to a different fluid. The air weaving machine comprises a number of groups of nozzles 11, 12, 13, 14 and 15 which, in the illustrated exemplary embodiment, consist of a relay blower. The relay blowers 11, 12 are connected to a storage tank 21 via an associated shut-off valve 16, 17, while the relay blowers 13, 14, 15 are connected to a storage tank 22 via an associated shut-off valve 18, 19, 20. The storage tank 21 is connected to a main storage tank 25 via a pressure-regulating valve 23, while the storage tank 22 is connected to a main storage tank 25 via a pressure-regulating valve 24. Via a pressure-regulating valve 26, the main storage tank 25 is connected to a supply system 27 which can supply a pressurized fluid. The supply system 27 comprises, for example, a compressor for supplying pressurized air.

[0030] In addition, nozzles 28, 29 which, in the illustrated embodiment, consist of a main blower, are connected to a storage tank 32 via a shut-off valve 30 and a throttle valve 31. Via a pressure-regulating valve 33,

the storage tank 32 is connected to the main storage tank 25. In addition, auxiliary devices 34 and 35 are also provided. The auxiliary device 34 is, for example, formed by a stretching blower and is connected to a storage tank 38 via a shut-off valve 36 and a throttle valve 37. The auxiliary device 35 is for example formed by a cleaning blower. According to a variant, an auxiliary device 34 or 35 can be formed by a cylinder for driving a thread clamp, by a blower which is present in a suction nozzle into which weft threads can be sucked, by a blower of a selvage tuck-in device or by yet other blowers or elements. The auxiliary device 35 is directly connected to the storage tank 38. In this case, it should be noted that the auxiliary device 35 is continuously provided with pressurized fluid and, for example, continuously consumes air. The storage tank 38 is connected to the main storage tank 25 via a pressure-regulating valve 39. Of course, according to a variant (not shown) yet other auxiliary devices may be provided which are provided with fluid via a storage tank.

[0031] In the illustrated exemplary embodiment, a shut-off valve may consist of a magnetic valve. The throttle valve may consist of a motor-driven throttle valve. The pressure-regulating valve may consist of a manually adjustable and/or motor-driven pressure-regulating valve. Fig. 1 diagrammatically shows manually adjustable pressure-regulating valves 23, 24, 26, 33, 39 which are arranged near the frame of the weaving machine.

[0032] In the supply line 4 from the supply system 27 to the main storage tank 25, a sensor device 2 according to the invention is provided, which comprises a sensor 5 in order to determine an actual value of the fluid stream through the main supply line 4. If the fluid stream consists of a pressurized air stream, the flow of compressed air per unit time is for example chosen as actual value, more particularly the measured mass flow of compressed air per unit time. The expression mass flow is understood to mean the flow which is determined by the mass of the fluid in the fluid stream which passes at the sensor. The mass flow is independent of the pressure of the fluid in the fluid stream.

[0033] The sensor 5 consists, for example, of a known mass flow sensor which generates an analog or digital signal which is a measurement value for the actual air flow through the sensor 5. An example of a possible sensor 5 is a sensor of the type SD8000 by IFM Electronics.

[0034] According to the invention, the insertion system 10 is controlled, more particularly monitored, by comparing the actual value of the fluid stream measured by the sensor device 2 with an expected value for the fluid stream. This may be carried out by means of the processing device 6. In order to allow this comparison, an expected value for the fluid stream is stored in the storage device 7. This expected value may be entered, for example, via the input device 8.

[0035] Preferably, the expected value is equal to a value determined with an associated reference setting. The measured values, the expected values and values derived there from, such as the difference between the

measured and the expected value, can be displayed on a display device 9, such as the display screen of the weaving machine provided for this purpose.

[0036] According to the invention, the expected value can be determined in various ways and subsequently be stored in the storage device 7. According to a first possibility, a reference setting is provided by setting the reference parameters of the shut-off valves 16, 17, 18, 19, 20, 30, 36, the reference parameters of the throttle valves 31, 37 and/or the reference parameters of the pressure-regulating valves 23, 24, 26, 33, 39 of the weaving machine. A reference setting may consist of a setting in which all shut-off valves 16, 17, 18, 19, 20, 30, 36 are in the closed position, all throttle valves 31, 37 set to maximum throttle and all pressure-regulating valves 23, 24, 26, 33, 39 are set to a minimum pressure. This reference setting allows a leakage fluid stream which is present in the main supply line 4 to be measured. If the insertion system 10 does not contain any leaks, a small leakage fluid stream is measured in this case, which is mainly the result of the auxiliary device 35 which provides a continuous fluid stream, for example to clean or cool an element. The measured value of the leakage fluid stream is subsequently stored in storage device 7. If the weaving machine is set to said reference setting some time later, and if a larger leakage fluid stream is measured, the processing device 6 is able to determine that somewhere an additional leak is present by comparing the actual leakage fluid stream with the stored value of the expected leakage fluid stream. This measurement is carried out while the weaving machine is at standstill. The image from Fig. 2 can be displayed on the display device 9, with the closed shut-off valves, the throttle valves set to maximum throttle and the pressure-regulating valves set for minimum pressure each for example being shown in a specific color, in which case a specific color may mean that they normally allow hardly any fluid stream to pass through.

[0037] According to another possibility, an actual value of the fluid stream is measured or determined while a certain article is being woven, for example the mass flow in Nm^3/h (normal cubic meters per hour) of fluid stream at the setting used for weaving. This actual value is stored as an expected value, in other words as an expected value for the fluid stream at the applied setting of the weaving machine during weaving. Then, while weaving is continued, the measured actual value is continuously compared to the expected value stored as mentioned above. In order to determine the actual value, a mean value may be determined over a certain time interval, for example over 10 seconds. An expected value is, for example, $58.2 \text{ Nm}^3/\text{h}$. If, for example, a leak or an irregularity occurs, it is possible to determine, with the aid of the device according to the invention, that the value of the actual flow substantially differs from the value of the expected flow, a fault message may be generated and displayed by means of the display device 9. In this case, an operator can investigate where the fault has occurred

and take appropriate action in order to remedy it, so that weaving can always take place at minimum flow and/or under optimum circumstances.

[0038] The actual value of the flow may be higher if, for example, a leak has occurred, while the actual value of the flow may be lower if, for example, a shut-off valve does not open. In addition, it is possible in this case to determine whether the flow gradually increases or decreases and/or the flow suddenly increases or decreases. These measurements may be displayed, for example, on the display device 9 in the form of a graph and allow the operator to determine whether an irregularity is present. If a continuous drop in the value of the actual flow is found, this may be an indication of soiling (clogging up) of one or more of the nozzles, for example of certain relay blowers. From the instant that the value of the actual flow becomes lower than the expected value of the flow by a certain percentage, a message may be generated, for example via the display screen of the weaving machine and/or via a warning system, for example a signal lamp of the weaving machine, that the nozzles require cleaning.

[0039] If the operator suspects that an irregularity is present, the operator can carry out a manual, semiautomatic or automatic check of the insertion system 10. Alternatively, such a check may be carried out automatically at predetermined times, for example every day, after every twenty weaving machine stops, after every change of warp beam or on the basis of still other parameters.

[0040] According to another possibility, an expected value for the fluid stream is determined and stored at a reference setting with certain reference parameters for the shut-off valves, the throttle valves and/or the pressure-regulating valves. Following this, an actual value can be determined at said reference setting at a later stage and be compared to the stored expected value. Based on the difference between the two, it is possible to determine an irregularity. For example, a reference setting may be chosen at which the pressure-regulating valves 23, 24, 26, 33, 39 are set to reference parameters such as during weaving, and at which the throttle valves 31, 37 are also set to reference parameters such as during weaving. With this reference setting, each of the shut-off valves 17, 18, 19, 20, 30 and 36 may be closed at the reference parameter, while the shut-off valve 16 is open at the reference parameter. In this case, for example, an actual value for the fluid stream, for example the flow of the compressed air stream, may be measured for said reference setting and be stored as an expected value for said reference setting. Then, each of the shut-off valves may be opened successively, while all other shut-off valves are closed. In this manner, it is possible to successively set different reference settings with associated reference parameters. This makes it possible to store an expected value at a certain reference setting for each group of nozzles which are connected to an associated shut-off valve. Thereby, in each case one expected value is determined for the fluid stream by means of a meas-

urement for a reference setting where only one shut-off valve is opened.

[0041] For example, the shut-off valve which is opened may in this case be opened for three seconds, with the measurement being started after one second and being stopped at three seconds. This allows a measurement of the fluid stream to be carried out under operating conditions. After a certain time, the insertion system can successively be returned to these reference settings, with in each case one actual value being determined. If the actual value substantially differs from the expected value, then an irregularity may be determined. A substantial difference may be determined as a percentage, for example more than 5% or more than 10% difference, or may be determined statistically depending on mean values and standard deviations. If the actual value is substantially higher, this may indicate a leak. If the actual value is substantially lower, this may indicate that a nozzle is soiled (clogged up) or that a shut-off valve is malfunctioning. The image from Fig. 2 may be displayed on the display device 9, with the valves which are associated with parts where an irregularity has been found being shown, for example, in red, while the valves which are associated with valves where no irregularity has been found are shown, for example, in green.

[0042] In a similar way, a value can be determined for each selected reference setting for a certain nozzle or a group of nozzles which can be stored as an expected value. Of course, it is possible to also successively open two or more shut-off valves at such a reference setting. In addition, the throttle valves and/or pressure-regulating valves can be moved to a position associated with the reference setting.

[0043] In the embodiment from Fig. 3, groups of relay blowers 11, 12, 13, 14, 15 are each connected to the same storage tank 21 via an associated shut-off valve 16, 17, 18, 19, 20. The storage tank 21 is in turn connected to the main storage tank 25 via a pressure-regulating valve 24. In this case, the main storage tank 25 is connected to the supply system 27 via a pressure-regulating valve 26 and a main supply line 4. A sensor device 2 with a sensor 5 is fitted in the main supply line 4. The sensor device 2 is connected to the processing device 6 in a manner as indicated in Fig. 2. According to one embodiment, the shut-off valves 16 to 20 are each successively opened while the other shut-off valves are closed and in each case an associated actual value is determined for the fluid stream. That is to say that the fluid stream is measured by means of the sensor device 2 for each group of relay blowers 11 to 15 which is connected to an associated shut-off valve 16 to 20. These measurements of the fluid stream are carried out at a certain setting of the pressure-regulating valves 24 and 26, which means that the measurements take place at a certain pressure of the fluid present in the storage tank 21. Following the measurements, a mean value for the fluid stream is determined for each group of relay blowers 11 to 15 as an average of the values measured as mentioned

above and stored as an expected value. Then, each measured value of the fluid stream for a group of relay blowers 11 to 15 is compared to the expected mean value for the fluid stream. In addition, it is possible to statistically determine the standard deviation of each value measured as mentioned above for the actual fluid stream for each group of relay blowers with respect to the determined mean expected value. If the actual measured value for a group of relay blowers differs substantially from the expected value, for example differs by more than twice the standard deviation from the expected value, it can be assumed that there is a fault or irregularity in the insertion system at the supply of fluid to said specific group of relay blowers. Such an embodiment is particularly suitable for detecting soiling (clogging up) of certain relay blowers, more particularly for determining that the fluid stream from relay blowers connected to a shut-off valve is substantially lower than the fluid stream from relay blowers connected to other shut-off valves.

[0044] According to one variant, it is also possible, after a substantial difference has been determined for a group of relay blowers, to leave the measured actual value for said group of relay blowers out of consideration and then to determine a mean value and a standard deviation for the remaining measured actual values for the other groups of relay blowers. The mean value is then stored again as the expected value. Thereafter, the actual value which has been left out of consideration can be compared to the expected value determined as mentioned above. If a substantial difference is still detected for said specific group of relay blowers, for example a difference which is three times the standard deviation, it can be assumed that a fault has occurred with that group of relay blowers.

[0045] According to yet another variant, the measured actual value for a group of relay blowers which is connected to a shut-off valve can be compared to an expected value which is determined as the mean value of the actual measured values which are associated with the other groups of relay blowers, each of which is connected to an associated shut-off valve. Such a method is advantageous if the groups of relay blowers are connected to the same storage tank or are supplied with fluid at the same pressure. This makes it possible to determine in a simple manner whether an irregularity has occurred by determining if the measured actual value for the fluid stream for a certain group of relay blowers differs substantially from the expected value.

[0046] According to a variant in which groups of relay blowers are each connected to a specific storage tank via an associated shut-off valve, the fluid stream through each of the number of groups of relay blowers which are connected to an associated shut-off valve can be measured using the sensor device. In this case, it is possible to determine a mean value for the fluid stream as an expected value for a number of these groups of relay blowers. The actual measured value for the fluid stream for each group of relay blowers can subsequently be com-

pared to the abovementioned expected value for the fluid stream. Then, a standard deviation for the measured values compared to the mean value determined as the expected value can be determined for the fluid stream.

5 Thereafter, it is possible to determine whether the actual value and the expected value for the fluid stream for a specific group of relay blowers differ substantially, based on the abovementioned standard deviation. Such a method is most advantageous when a large number of groups of relay blowers are connected to the same storage tank and is particularly suitable to determine whether a specific group of relay blowers comprises a soiled (clogged up) relay blower.

[0047] The abovementioned methods make it possible to determine, based on the measured actual values, whether certain measured actual values are substantially different from the other measured values, that is to say from the expected values. In this case, it is possible, easily and without the intervention of an operator, according to the invention, to automatically carry out a check of the insertion system 10 which makes it possible to determine whether the fluid stream to a specific group of relay blowers is substantially larger or smaller than the fluid stream to the other groups of relay blowers. If the relay blowers of each group are of identical design, and are connected to the same storage tank, it is reasonable to expect that they use the same amount of fluid when they are supplied with fluid. This means that this method can be carried out at any fluid pressure, in other words an irregularity can be detected with such a method at any fluid pressure.

[0048] The device 10 illustrated in Fig. 4 comprises a number of groups of nozzles 41, 42, 43, 44, 45, 46, 47 in the form of relay blowers. Via an associated shut-off valve 51, 52, 53, 54, 55, 56, 57, each group of nozzles is connected to the same storage tank 21 which is connected to a main storage tank 25 via a pressure-regulating valve 23. Via a pressure-regulating valve 26, the main storage tank 25 is connected to a supply system 27 which can supply fluid under pressure. The sensor device 2 with sensor 5 is connected to the main supply line 4, a processing device 6, a storage device 7, an input device 8 and a display device 9 in a way similar to that of the embodiments from Figs. 2 and 3. The groups of nozzles 41, 43, 44, 47 comprise two nozzles, while the groups of nozzles 42, 45, 46 comprise three nozzles.

[0049] If the nozzles and the shut-off valves are of virtually identical design, it is possible to determine that at the same pressure of the fluid supplied, the value of the fluid stream through the groups of three nozzles is, for example, greater by a factor of 1.4 than the value of the fluid stream through the groups of two nozzles. It is assumed that the fluid stream through one nozzle of a group of two nozzles is equal to "1/2" of the fluid stream through said group of nozzles. For a group of three nozzles, the fluid stream through one nozzle is equal to "1/3" of the fluid stream of the group of nozzles. In order to make a comparison possible between the fluid stream through one nozzle from a group of three nozzles and the fluid

stream through one nozzle from a group of two nozzles, a correction factor may be used. In the abovementioned example, a correction factor of "1/2" can be used for the group of two nozzles, while a correction factor of "1/2.8" can be chosen for the group of three nozzles at the abovementioned factor 1.4. Each correction factor is in this case determined while taking into account the number of nozzles of the respective group of nozzles, more particularly the number of relay blowers which are connected to the same shut-off valve. The correction factors can be input by means of the input device 8 and stored in the storage device 7. This means that, if the correction factor is taken into account, for each separate nozzle under ideal circumstances and at the same pressure of the supplied fluid, an identical value will be obtained for the fluid stream, more particularly for the flow. As a result thereof, it is possible to determine the fluid stream at each nozzle and compare it to an expected value.

[0050] If the fluid stream through the group of nozzles 41 is, for example, $3.2 \text{ Nm}^3/\text{h}$, then the fluid stream through each of the nozzles of the group of nozzles 41 will be $1.6 \text{ Nm}^3/\text{h}$. If the fluid stream through the group of nozzles 42 is for example $4.5 \text{ Nm}^3/\text{h}$, the fluid stream through each nozzle of the group of nozzles 42 will then be $1.5 \text{ Nm}^3/\text{h}$, i.e. a third of the total fluid stream. However, if the correction factor is taken into account, then the value of the fluid stream is $1.6 \text{ Nm}^3/\text{h}$, which is equal to the value obtained when the value of the total fluid stream of $4.5 \text{ Nm}^3/\text{h}$ is divided by the correction factor 2.8. Such a value for a relay blower of a group of three relay blowers can thus be compared to the value for a relay blower of a group of two relay blowers with a certain degree of accuracy. Thereby, in order still to be able to compare a fluid stream through the relay blowers of groups comprising different numbers of relay blowers with one another and/or with the same expected value, the number of relay blowers connected to a shut-off valve is taken into account. Taking into account the correction factors, it is possible to carry out all the methods described with reference to Fig. 3 in the same manner for the embodiment from Fig. 4. Likewise and in a similar manner, mean values and standard deviations compared to the mean values of measured values can be determined for the fluid stream, more particularly for the fluid stream which has been modified using correction factors.

[0051] According to another possibility, in the embodiment from Fig. 2, the main fluid stream in the main supply line 4 can be measured when the weaving machine is at a standstill. This may be carried out while the throttle valves 31, 37 and the pressure-regulating valves 23, 24, 26, 33, 39 are still in the position they had during weaving. If no shut-off valves are driven, this main fluid stream can be considered to be a leakage fluid stream. If the leakage fluid stream is greater than the leakage fluid stream which was measured in a similar manner after the setting of the weaving machine and was stored as an expected value, it may be concluded that there is an additional leak. In the case of manually operated pressure-regulating

valves 23, 24, 26, 33, 39, it is desirable to store the set positions of these pressure-regulating valves, for example to store them in the storage device 7 of the weaving machine. This makes it possible to return the insertion system of the weaving machine to the previously set setting or parameters after the control according to the invention. Then, the pressure-regulating valve 23 can be set to minimum pressure in order to determine whether the leakage fluid stream decreases. If this is the case, it can be assumed that the leak is downstream of the pressure-regulating valve 23. If this is not the case, the pressure-regulating valve 24 can be set to minimum pressure in order to determine again if the leakage fluid stream decreases. In a similar manner, the pressure-regulating valves 33 and 39 can be set to minimum pressure in order to control whether the leakage fluid stream decreases. If the leakage fluid stream then still has not decreased, the pressure-regulating valve 26 can subsequently be set to minimum pressure. If the leakage fluid stream then still has not decreased, it may be concluded that the leak is at the main supply line 4. After this control, the pressure regulators can be returned to the position they were in before the monitoring. Then weaving can be resumed again.

[0052] According to the embodiment shown in Fig. 5, the sensor device 2 can also comprise a sensor 48, 49 and/or 50 which is associated with at least one nozzle. According to this embodiment, the sensor 48 is associated with a main blower 28, the sensor 49 is associated with the group of relay blowers 11 and the sensor 50 is associated with the main blower 40. In this embodiment, the main blower 40 is connected to the shut-off valve 36 which is connected to the storage tank 38 via a throttle valve 37. Of course, another sensor may be fitted which is associated with one relay blower, with one or more groups of relay blowers, with one main blower and/or with one or more groups of main blowers. The sensors 48, 49, 50 are each connected to the processing device 6 in order to send analog or digital signals to the processing device 6 and/or to receive analog or digital signals from the processing device 6.

[0053] As is indicated diagrammatically in Fig. 1, the control unit 58 of the weaving machine may be connected to the processing device 6. In a similar manner, the control unit 58 can also be connected to the storage device 7, the input device 8 and the display device 9. The control unit 58 can also control all elements of the insertion system 10, more particularly can drive all the abovementioned valves in accordance with a control program. The processing device 6, the storage device 7 and the input device 8 can in practice form part of one single physical unit, for example an electronic circuit board with inputs and outputs for signals. Such a circuit board may be fitted in the control unit 58 of the weaving machine.

[0054] It is advantageous to carry out a method according to the invention with an open shed. This prevents the warp threads from being exposed to fluid when carrying out the method according to the invention, which

might lead to damage of the warp threads.

[0055] Of course, variants and combinations of the illustrated reference settings are possible. When selecting the reference settings, it may be desirable to set the pressure-regulating valves to maximum or minimum settings. In a similar manner, the throttle valves may be set to maximum or minimum settings. This makes it possible to accurately measure the effect of the fluid stream through this shut-off valve or through these shut-off valves when the shut-off valve is open or a number of shut-off valves are open, i.e. without substantial effect of irregularities at other elements or components of the insertion system.

[0056] Of course, according to a variant (not shown) only one nozzle may be provided per shut-off valve, for example one relay blower, or more than three nozzles may be provided, for example more than three relay blowers. In this case, the associated correction factors can also be determined.

[0057] If an operator activates the monitoring of the insertion system according to a method according to the invention, the control unit 58 of the device 1 will initially check if a sensor device 2 with at least one sensor 5, 48, 59, 50 is present, more particularly will check whether the sensor device 2 generates an analog or digital signal. If this is not the case, this will be indicated on the display device 9 of the weaving machine and the method of the invention will not be carried out.

[0058] According to the invention, a fluid stream from at least one nozzle is measured and compared to an expected value. In this case, the nozzle is not limited to at least one relay blower and/or at least one main blower, but the nozzle may comprise any kind of nozzle used in a weaving machine, for example a stretching blower for a weft thread, a holding blower for a weft thread, a sel-edge tuck-in blower for a weft thread end, a cleaning blower, any other kind of known blower for a weaving machine and the like.

[0059] The device and method according to the invention illustrated and described in the exemplary embodiments is not limited to the use in an air weaving machine, but can be used in any type of weaving machine in which a weft thread is introduced into a shed by means of a fluid, for example also with water jet weaving machines or other types of fluid weaving machines.

[0060] The device and method according to the invention described in the claims are not limited to the exemplary embodiments described by way of example, but can also comprise variants and combinations thereof which are within the scope of the claims.

Claims

1. Method for monitoring an insertion system (10) for a weaving machine, wherein at least one actual value of a fluid stream is measured by means of a sensor device (2), and wherein the measured actual value

of the fluid stream is compared to an expected value, **characterized in that**

the fluid stream for each of a number of groups of nozzles (11, 12, 13, 14, 15; 41, 42, 43, 44, 45, 46, 47) which are connected to an associated shut-off valve (16, 17, 18, 19, 20; 51, 52, 53, 54, 55, 56, 57) which is connected to a specific storage tank (21) is measured using the sensor device (2), and a mean value for the fluid stream for a number of these groups of nozzles (11, 12, 13, 14, 15; 41, 42, 43, 44, 45, 46, 47) is determined as the expected value.

2. Method as claimed in claim 1, **characterized in that** depending on a standard deviation of the measured values by means of which the abovementioned mean value for the fluid stream was determined, it is determined whether there is a substantial difference between the measured value for the fluid stream and the expected value of the fluid stream.

3. Method as claimed in one of the claims 1 or 2, **characterized in that** the fluid stream from a nozzle of a group of nozzles (11, 12, 13, 14, 15; 41, 42, 43, 44, 45, 46, 47) is determined by means of a correction factor and taking into account the number of nozzles of the group.

4. Method as claimed in claim 1, 2 or 3, **characterized in that** a main fluid stream in a main supply line (4) of the weaving machine is measured.

5. Method as claimed in one of the claims 1 to 4, **characterized in that** a reference setting is provided for determining an expected value and/or an actual value by setting reference parameters of the valves (16, 17, 18, 19, 20, 30, 36; 31, 37; 23, 24, 26, 33, 39; 51, 52, 53, 54, 55, 56, 57) of the weaving machine.

6. Method as claimed in claim 5, **characterized in that** a leakage fluid stream which is present in the main supply line (4) is measured.

7. Method as claimed in one of the claims 1 to 6, **characterized in that** at least one expected value for the fluid stream is determined by means of a measurement for a reference setting, in which only one shut-off valve (16, 17, 18, 19, 20, 30, 36; 51, 52, 53, 54, 55, 56, 57) is open.

8. Method as claimed in claim 7, **characterized in that** in order to determine the expected values, a fluid stream is measured according to a reference setting of the weaving machine.

9. Method as claimed in one of the claims 1 to 8, **characterized in that** a fluid stream from at least one relay blower (11, 12, 13, 14, 15; 41, 42, 43, 44, 45, 46, 47) which is connected to a shut-off valve and/or

from at least one main blower (28, 29; 40) which is connected to a shut-off valve is measured.

10. Device for monitoring an insertion system (10) for a weaving machine, wherein the device (10) comprises a sensor device (2) for measuring at least one actual value of a fluid stream and a processing device (6) connected to the sensor device (2) for comparing a measured actual value of the fluid stream with an expected value for the fluid stream, **characterized in that** the sensor device (2) is arranged for measuring the fluid stream for each of a number of groups of nozzles (11, 12, 13, 14, 15; 41, 42, 43, 44, 45, 46, 47) which are connected to an associated shut-off valve (16, 17, 18, 19, 20; 51, 52, 53, 54, 55, 56, 57) which is connected to a specific storage tank (21), and the processing device (6) is arranged for determining a mean value for the fluid stream for a number of these groups of nozzles (11, 12, 13, 14, 15; 41, 42, 43, 44, 45, 46, 47) as the expected value.
11. Device as claimed in claim 10, **characterized in that** the sensor device (2) comprises a sensor (5) arranged in a main supply line (4) of the weaving machine.
12. Device as claimed in the claim 10 or 11, **characterized in that** the device (1) comprises a storage device (7) in which at least one expected value for the fluid stream is stored.
13. Device as claimed in claim 12, **characterized in that** correction factors are stored in the storage device (7) for separate nozzles and/or several nozzles connected to shut-off valves (16, 17, 18, 19, 20, 30, 36; 51, 52, 53, 54, 55, 56, 57), as a result of which the number of nozzles (11, 12, 13, 14, 15; 41, 42, 43, 44, 45, 46, 47) connected to a shut-off valve can be taken into account for the associated expected values.
14. The device as claimed in one of claims 10 to 13, **characterized in that** the sensor device (2) comprises a sensor (48, 49, 50) which is associated with a relay blower, a group of relay blowers, a main blower and/or a group of main blowers.

Patentansprüche

1. Verfahren zur Überwachung eines Eintragungssystems (10) für eine Webmaschine, wobei mindestens ein Ist-Wert eines Fluidstroms mittels einer Sensorvorrichtung (2) gemessen wird, und wobei der gemessene Ist-Wert des Fluidstroms mit einem Erwartungswert verglichen wird, **dadurch gekennzeichnet, dass** der Fluidstrom für jede einer Anzahl von

Gruppen von Düsen (11, 12, 13, 14, 15; 41, 42, 43, 44, 45, 46, 47), die mit einem zugehörigen Absperrventil (16, 17, 18, 19, 20; 51, 52, 53, 54, 55, 56, 57) verbunden sind, das mit einem bestimmten Speicherbehälter (21) verbunden ist, mittels der Sensorvorrichtung (2) gemessen wird, und ein Mittelwert für den Fluidstrom für eine Anzahl dieser Gruppen von Düsen (11, 12, 13, 14, 15; 41, 42, 43, 44, 45, 46, 47) als den Erwartungswert bestimmt wird.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** abhängig von einer Standardabweichung der gemessenen Werte, mit welchen der obengenannte Mittelwert für den Fluidstrom bestimmt wurde, es bestimmt wird, ob es einen wesentlichen Unterschied zwischen dem gemessenen Wert für den Fluidstrom und dem Erwartungswert des Fluidstroms gibt.
3. Verfahren nach einem der Ansprüche 1 oder 2, **dadurch gekennzeichnet, dass** der Fluidstrom von einer Düse einer Gruppe von Düsen (11, 12, 13, 14, 15; 41, 42, 43, 44, 45, 46, 47) bestimmt wird mittels eines Korrekturfaktors und unter Berücksichtigung der Anzahl von Düsen der Gruppe.
4. Verfahren nach Anspruch 1, 2 oder 3, **dadurch gekennzeichnet, dass** ein Haupt-Fluidstrom in einer Haupt-Zufuhrleitung (4) der Webmaschine gemessen wird.
5. Verfahren nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** eine Referenzeinstellung zum Bestimmen eines Erwartungswerts und/oder eines Ist-Werts durch Einstellung von Referenzparametern der Ventile (16, 17, 18, 19, 20, 30, 36; 31, 37; 23, 24, 26, 33, 39; 51, 52, 53, 54, 55, 56, 57) der Webmaschine vorgesehen ist.
6. Verfahren nach Anspruch 5, **dadurch gekennzeichnet, dass** ein Leck-Fluidstrom, der in der Haupt-Zufuhrleitung (4) vorliegt, gemessen wird.
7. Verfahren nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** mindestens ein Erwartungswert für den Fluidstrom mittels eine Messung für eine Referenzeinstellung bestimmt wird, wobei nur ein Absperrventil (16, 17, 18, 19, 20, 30, 36; 51, 52, 53, 54, 55, 56, 57) geöffnet ist.
8. Verfahren nach Anspruch 7, **dadurch gekennzeichnet, dass** ein Fluidstrom entsprechend einer Referenzeinstellung der Webmaschine gemessen wird, um die Erwartungswerte zu bestimmen.
9. Verfahren nach einem der Ansprüche 1 bis 8, **dadurch gekennzeichnet, dass** ein Fluidstrom von mindestens einer Hilfsdüse (11, 12, 13, 14, 15; 41,

42, 43, 44, 45, 46, 47), die mit einem Absperrventil verbunden ist, und/oder von mindestens einer Hauptdüse (28, 29; 40), die mit einem Absperrventil verbunden ist, gemessen wird.

10. Vorrichtung zur Überwachung eines Eintragungssystems (10) für eine Webmaschine, wobei die Vorrichtung (10) eine Sensorvorrichtung (2) zur Messung von mindestens einem Ist-Wert eines Fluidstroms und eine Verarbeitungsvorrichtung (6) verbunden mit der Sensorvorrichtung (2) zum Vergleichen eines gemessenen Ist-Wert des Fluidstroms mit einem Erwartungswert für den Fluidstrom umfasst,

dadurch gekennzeichnet, dass die Sensorvorrichtung (2) angeordnet ist zum Messen des Fluidstroms für jede einer Anzahl von Gruppen von Düsen (11, 12, 13, 14, 15; 41, 42, 43, 44, 45, 46, 47), die mit einem zugehörigen Absperrventil (16, 17, 18, 19, 20, 51, 52, 53, 54, 55, 56, 57) verbunden sind, das mit einem bestimmten Speicherbehälter (21) verbunden ist, und die Verarbeitungsvorrichtung (6) angeordnet ist zum Bestimmen eines Mittelwerts für den Fluidstrom für eine Anzahl dieser Gruppen von Düsen (11, 12, 13, 14, 15; 41, 42, 43, 44, 45, 46, 47) als den Erwartungswert.

11. Vorrichtung nach Anspruch 10, **dadurch gekennzeichnet, dass** die Sensorvorrichtung (2) einen Sensor (5) enthält, der in einer Haupt-Zufuhrleitung (4) der Webmaschine angeordnet ist.

12. Vorrichtung nach Anspruch 10 oder 11, **dadurch gekennzeichnet, dass** die Vorrichtung (1) eine Speichervorrichtung (7) enthält, in welcher mindestens einen Erwartungswert für den Fluidstrom gespeichert ist.

13. Vorrichtung nach Anspruch 12, **dadurch gekennzeichnet, dass** Korrekturfaktoren in der Speichervorrichtung (7) gespeichert werden für separate Düsen und/oder mehrere Düsen, die mit Absperrventilen (16, 17, 18, 19, 20, 30, 36; 51, 52, 53, 54, 55, 56, 57) verbunden sind, wodurch die Anzahl von Düsen (11, 12, 13, 14, 15; 41, 42, 43, 44, 45, 46, 47), die mit einem Absperrventil verbunden sind, für die zugehörigen Erwartungswerte berücksichtigt werden können.

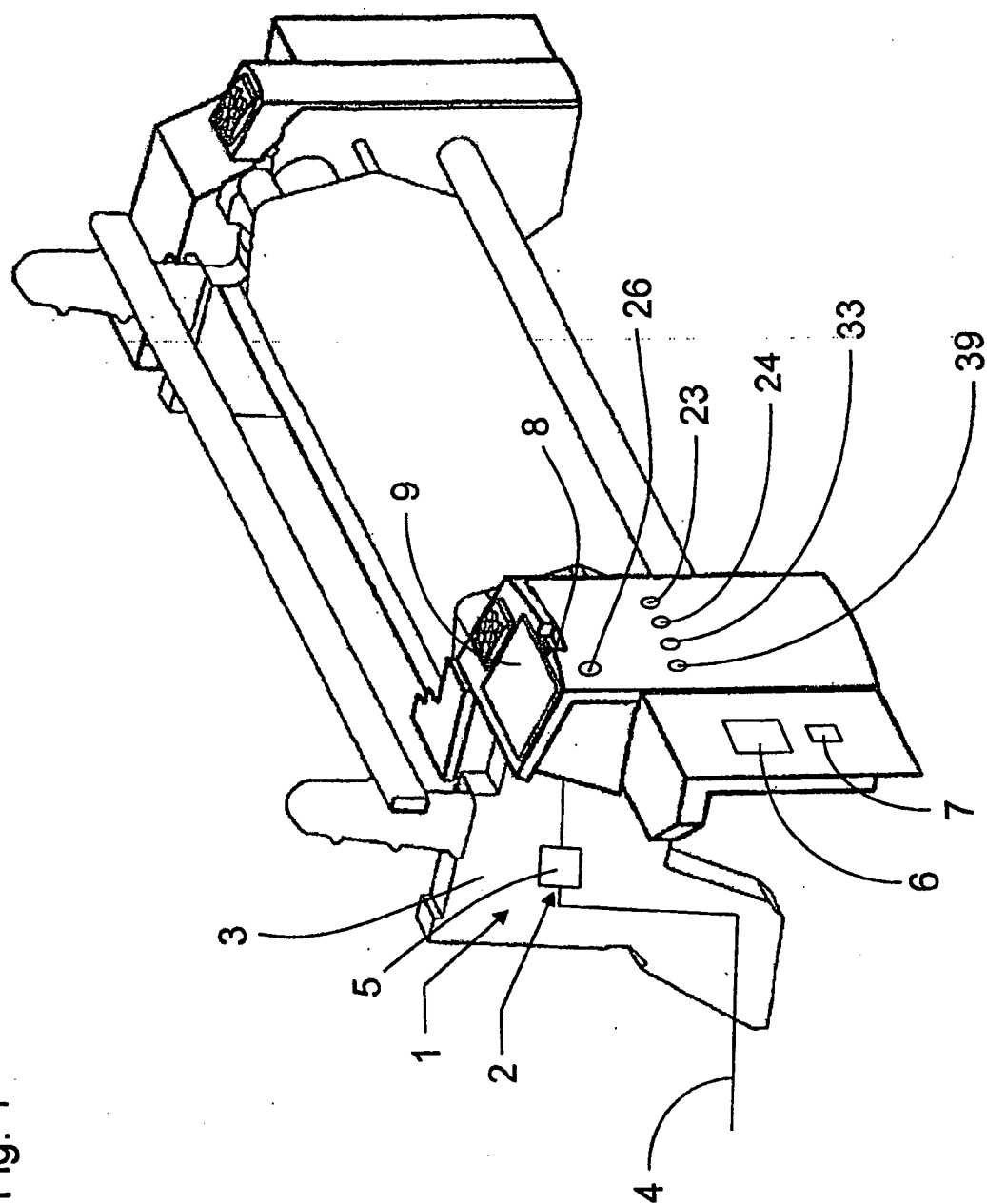
14. Die Vorrichtung nach einem der Ansprüche 10 bis 13, **dadurch gekennzeichnet, dass** die Sensorvorrichtung (2) einen Sensor (48, 49, 50) enthält, der einer Hilfsdüse, einer Gruppe von Hilfsdüsen, einer Hauptdüse und/oder einer Gruppe von Hauptdüsen zugeordnet ist.

Revendications

1. Procédé pour surveiller un système d'insertion (10) pour une machine à tisser, dans lequel au moins une valeur réelle d'un courant fluide est mesurée au moyen d'un dispositif de détection (2), et dans lequel la valeur réelle mesurée du courant fluide est comparée à une valeur attendue, **caractérisé en ce que** le courant fluide pour chacun d'un nombre de groupes de buses (11, 12, 13, 14, 15; 41, 42, 43, 44, 45, 46, 47) qui sont reliés à une soupape d'arrêt associée (16, 17, 18, 19, 20; 51, 52, 53, 54, 55, 56, 57) qui est reliée à un réservoir de stockage spécifique (21) est mesuré en utilisant le dispositif de détection (2), et une valeur moyenne pour le courant fluide pour un nombre de ces groupes de buses (11, 12, 13, 14, 15; 41, 42, 43, 44, 45, 46, 47) est déterminée comme la valeur attendue.
2. Procédé selon la revendication 1, **caractérisé en ce qu'en** fonction d'une déviation standard des valeurs mesurées au moyen duquel la valeur moyenne susmentionnée pour le courant fluide a été déterminée, il est déterminé s'il existe une différence substantielle entre la valeur mesurée pour le courant fluide et la valeur attendue du courant fluide.
3. Procédé selon l'une quelconque des revendications 1 ou 2, **caractérisé en ce que** le courant fluide à partir d'une buse d'un groupe de buses (11, 12, 13, 14, 15; 41, 42, 43, 44, 45, 46, 47) est déterminé au moyen d'un facteur de correction et en tenant compte du nombre de buses du groupe.
4. Procédé selon la revendication 1, 2 ou 3, **caractérisé en ce qu'un** courant fluide principal dans un conduit d'alimentation principal (4) de la machine à tisser est mesuré.
5. Procédé selon l'une quelconque des revendications 1 à 4, **caractérisé en ce qu'un** réglage de référence est prévu pour déterminer une valeur attendue et/ou une valeur réelle en réglant les paramètres de référence des soupapes (16, 17, 18, 19, 20, 30, 36; 31, 37; 23, 24, 26, 33, 39; 51, 52, 53, 54, 55, 56, 57) de la machine à tisser.
6. Procédé selon la revendication 5, **caractérisé en ce qu'une** fuite du courant fluide qui est présente dans le conduit d'alimentation principal (4) est mesurée.
7. Procédé selon l'une quelconque des revendications 1 à 6, **caractérisé en ce qu'au** moins une valeur attendue pour le courant fluide est déterminée au moyen d'une mesure pour un réglage de référence, dans lequel seulement une soupape d'arrêt (16, 17, 18, 19, 20, 30, 36 ; 51, 52, 53, 54, 55, 56, 57) est ouverte.

8. Procédé selon la revendication 7, **caractérisé en ce que**, afin de déterminer les valeurs attendues, un courant fluide est mesuré selon un réglage de référence de la machine à tisser. 5
9. Procédé selon l'une quelconque des revendications 1 à 8, **caractérisé en ce qu'**un courant fluide à partir d'au moins une buse-relais (11, 12, 13, 14, 15; 41, 42, 43, 44, 45, 46, 47) qui est relié à une soupape d'arrêt et/ou à partir d'au moins une buse principale (28, 29; 40) qui est reliée à une soupape d'arrêt est mesuré. 10
10. Dispositif pour surveiller un système d'insertion (10) pour une machine à tisser, dans lequel le dispositif (10) comprend un dispositif de détection (2) pour mesurer au moins une valeur réelle d'un courant fluide et un dispositif de traitement (6) relié au dispositif de détection (2) pour comparer une valeur réelle mesurée du courant fluide avec une valeur attendue pour le courant fluide, **caractérisé en ce que** le dispositif de détection (2) est disposé pour mesurer le courant fluide pour chacun d'un nombre de groupes de buses (11, 12, 13, 14, 15; 41, 42, 43, 44, 45, 46, 47) qui sont reliés à une soupape d'arrêt associée (16, 17, 18, 19, 20; 51, 52, 53, 54, 55, 56, 57) qui est relié à un réservoir de stockage spécifique (21), et 20
le dispositif de traitement (6) est disposé pour déterminer une valeur moyenne pour le courant fluide pour un nombre de ces groupes de buses (11, 12, 13, 14, 15; 41, 42, 43, 44, 45, 46, 47) comme la valeur attendue. 25
30
11. Dispositif selon la revendication 10, **caractérisé en ce que** le dispositif de détection (2) comprend un détecteur (5) disposé dans un conduit d'alimentation principal (4) de la machine à tisser. 35
12. Dispositif selon la revendication 10 ou 11, **caractérisé en ce que** le dispositif (1) comprend un dispositif de stockage (7) où au moins une valeur attendue pour le courant fluide est stockée. 40
13. Dispositif selon la revendication 12, **caractérisé en ce que** des facteurs de correction sont stockés dans le dispositif de stockage (7) pour des buses séparées et/ou plusieurs buses reliées à des soupapes d'arrêt (16, 17, 18, 19, 20, 30, 36; 51, 52, 53, 54, 55, 56, 57), à la suite de laquelle le nombre de buses (11, 12, 13, 14, 15; 41, 42, 43, 44, 45, 46, 47) relié à une soupape d'arrêt peut être tenu en compte pour les valeurs attendues associées. 45
50
14. Le dispositif selon l'une quelconque des revendications 10 à 13, **caractérisé en ce que** le dispositif de détection (2) comprend un détecteur (48, 49, 50) qui est associé à une buse-relais, un groupe de buses-relais, une buse principale et/ou un groupe de buses principaux. 55

Fig. 1



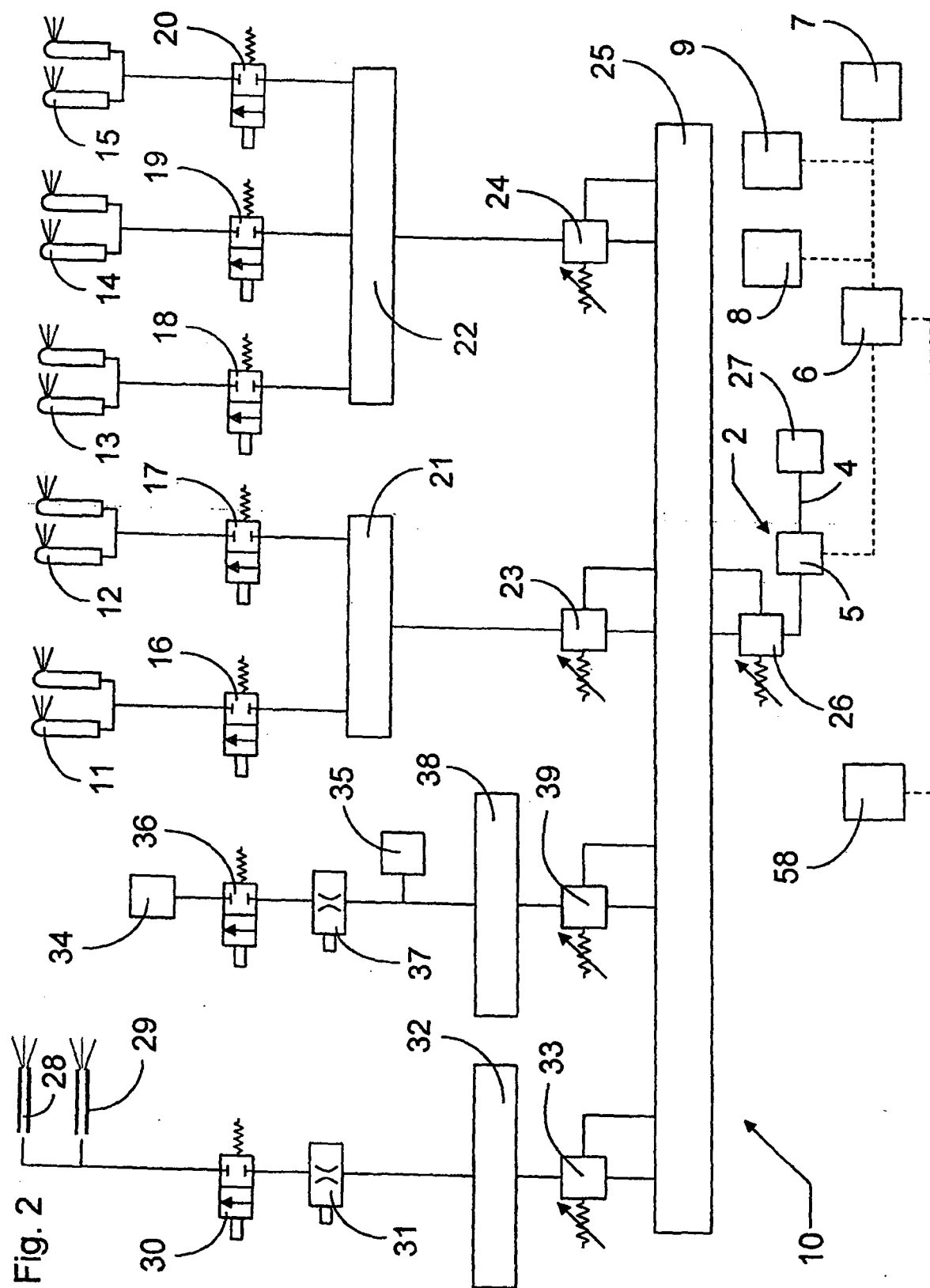
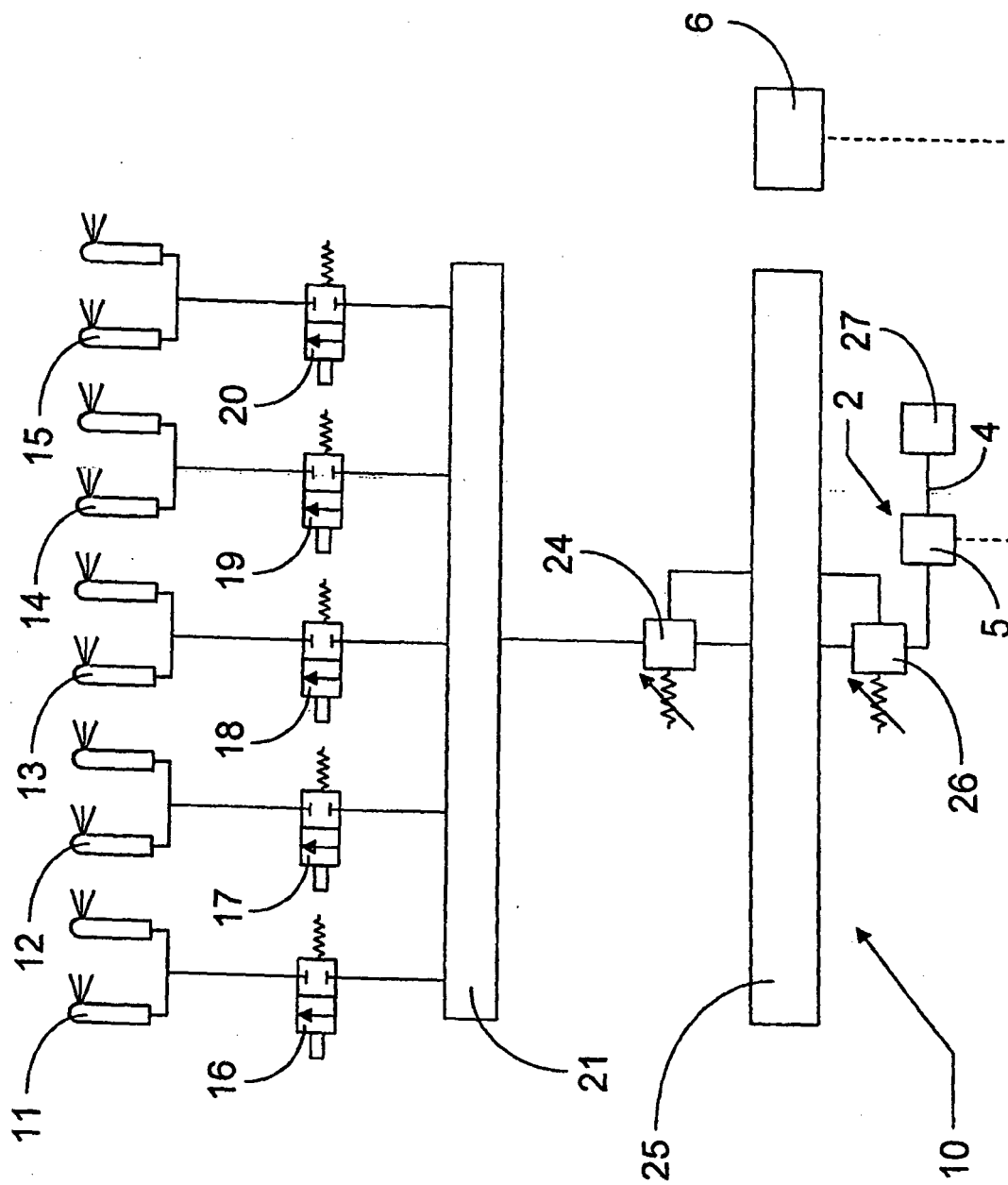
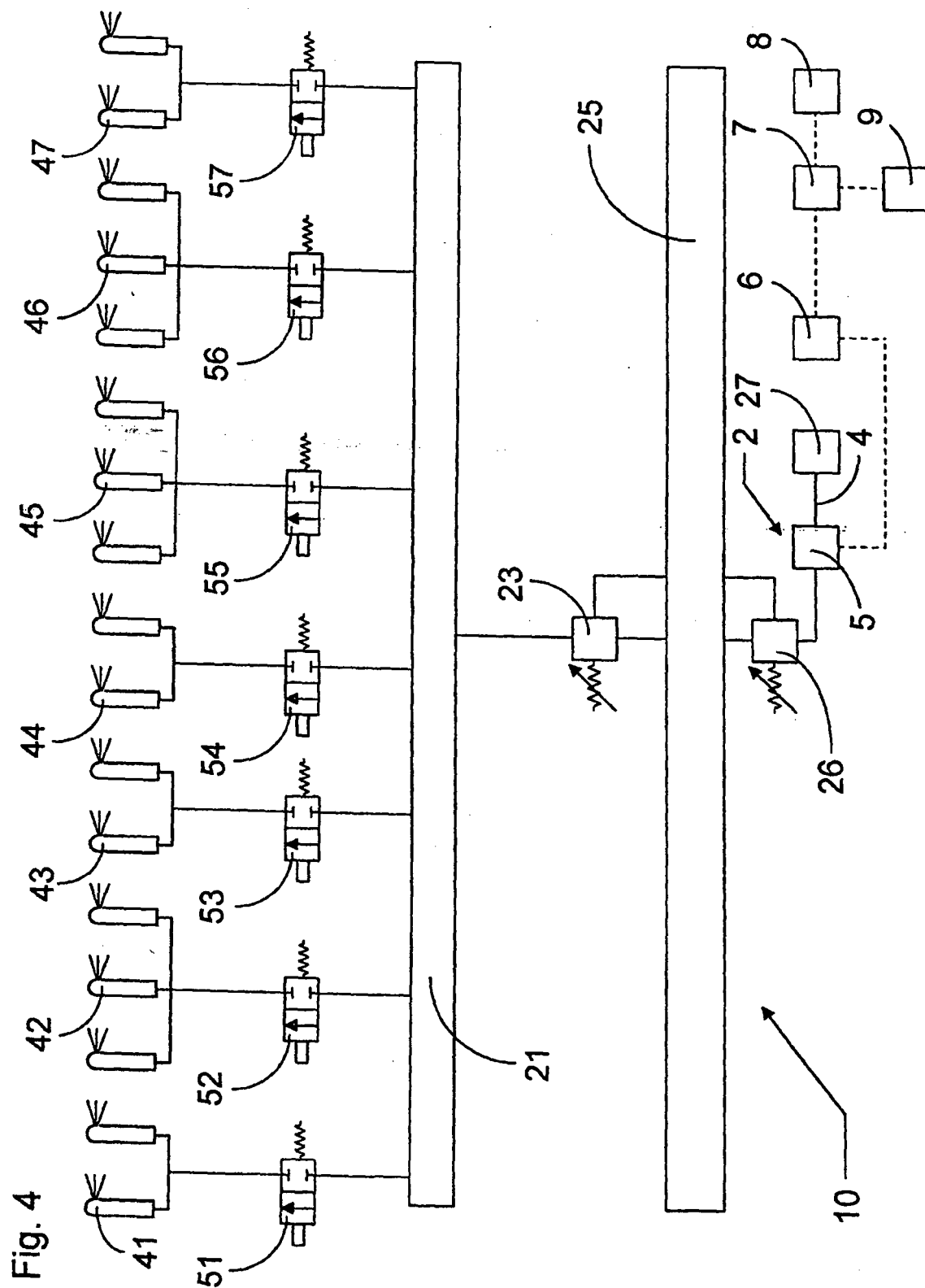
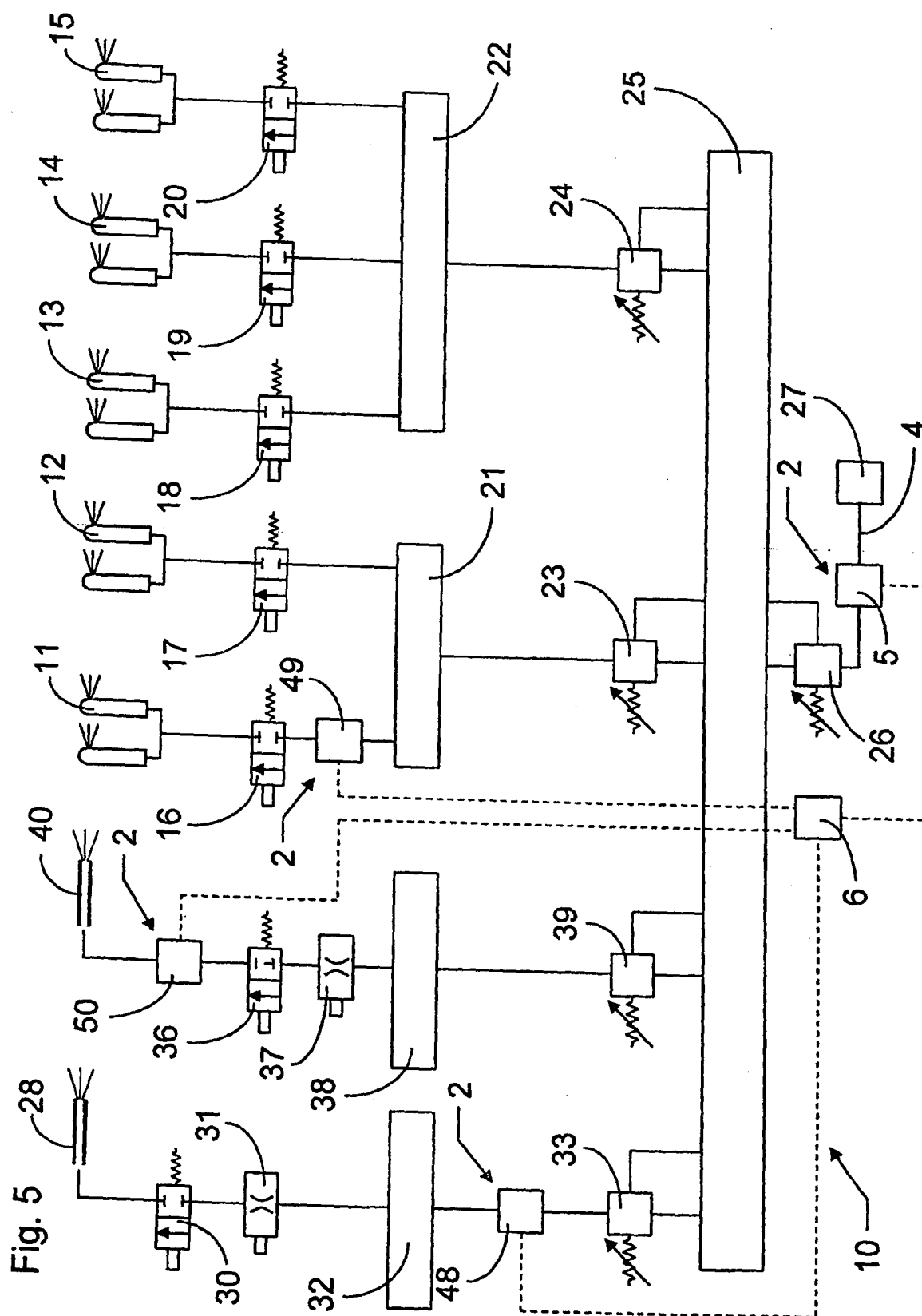


Fig. 3







REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- DE 19936071 C1 [0003]
- JP 2002138346 A [0004]
- JP 2175956 A [0006]